

STRUCTURE AND PROPERTIES OF CARBON BASED NANOCOMPOSITE FILMS.

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Magnetron sputtered amorphous CN_x films constitute a relatively new class of industrially applied thin films. They have been used since the 1990's as protective coatings of hard disks and recorder heads. Presently the research focuses on *fullerene-like* CN_x thin films.

DC sputtered Carbon, CN_x and Carbon–Nickel and Carbon–Nitride–Nickel thin films were investigated by high resolution electron microscopy, X-ray microanalysis and nanoindentation to clarify the influence of Nitrogen and Ni additions on the structure formation and mechanical properties. The films were deposited in argon or nitrogen plasma at temperatures from 25 to 800 °C onto NaCl and SiO_2 substrates. The microstructures of the Ni containing films can be described as nanocomposites, built from Ni or Ni_3C nanocrystals in a carbon/ CN_x matrix. The mechanical properties of the films were found to be strongly dependent on the substrate-temperature along with the changes of the structure. The highest nanohardness of 14 GPa was measured for the film grown at 200 °C, while low values (down to 2 GPa) were obtained for high temperature deposition. The change of the hardness is thought to be primarily the consequence of morphological changes of the crystalline phase from columnar to globular in the temperature range 200-800°C. TEM measurements confirm that Ni enhances the formation of ordered C/ CN_x structures as graphitic shells and fullerene-like domains in sputter-deposited films.

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